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Sciences

ABSTRACT

Designed to present interesting facts about science and to heighten the curiosity of primary age students, this book contains activities about the natural world and numerous black and white illustrations. The activities specifically focus on space science and allow the children to view themselves as future space scientists. Section one contains activities on astronauts. The second section emphasizes space travel and examines gravity and provides directions for constructing a rocket booster. A number of experiments as well as songs and games about the sun, moon, and the solar system are included in the third section. A certificate to acknowledge students as future astronauts is also provided. The teacher/parent guide section contains the answer keys for the activities. (ML)

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EXPLORE The Sun, Moon & Stars

BOOK 9 PRIMARY LEVEL

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by Elaine Scott

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SE 047 857

YOUNG SCIENTISTS EXPLORE

THE SUN, MOON & STARS

BOOK 9—PRIMARY LEVEL

by
LINDA PENN

illustrated by **ELAINE SCOTT**

cover by **VALERIE LEEDOM** and **TOM SJOERDSMA**

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PREFACE

Fellow Teachers and Parents,

How exciting it is to consider the potential of future space explorations and the impact this science will have on tomorrow's adults. This book will initially allow children to see themselves as "growing-up astronauts." Their involvement in everyday activities that serve to educate, to train, and to promote a mentally and physically healthy body are the basis for developing the well-rounded personality of a future space scientist. The children will letter-key their activities in a "Find-the-Sign" Game. Active sports and good health habits get an **H** for **Healthy**. Classroom study and activities rate an **E** for **Education**. Musical training, scouting and similar extracurricular pursuits could merit a **T** for **Training**, since they promote finger dexterity, mental alertness and many useful skills. Whether furthering their **Health**, **Education**, or **Training**, children will recognize the importance of these everyday activities not only to a space career, but to living an enjoyable, fulfilling life. This first section can help children feel good about themselves as they come to realize science holds a place for them.

Students can look at the problem posed by earth's gravity while the book's aspiring astronauts, Jennifer and Jon, plan a make-believe journey into space. They will construct a rocket booster and play the "Gravity Game" in an attempt to demonstrate how the "push" of thrust overcomes the "pull" of gravity. The science fun will continue as the Sun, the Star and center of the Solar System is introduced. Its importance will be investigated through two Sun-Science experiments. Directions are given for putting together the Sun, Moon and Planets to provide props for an Outer Space Play, complete with musical score. The spinning of the earth will be explored through its obvious consequence, day and night, when the children classify living things as diurnal or nocturnal. They can also play the part of Space Engineer and design a Lunar Lander or conduct an experiment to stimulate the moon's reflection of the sun's light.

The sky's the limit (or is it?). There is so much more to learn and to do if you . . .

Reach out for the hands
of a curious child.
Share living science,
for it opens young eyes
TO THE WONDER AND BEAUTY OF LIFE.

Your friend in science,

Linda Penn

SPACESHIP
SCIENCE



Words & Spaces

This is Jennifer and this is Jon.

Someday they'll put a

 _____ on.

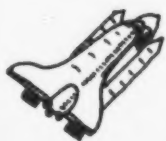
Both Jenny and Jon intend to be
an  _____ in space you see.

Jon just finished a spacekit model,
a super spacecraft called

the  _____.

Jon says it carries a crew of seven,
a well-trained team

of  _____ and  _____.



shuttle



astronaut



women



men



space suit



Jenny smiles, for she knows Jon's right.

She's read about the



_____ 's flight.

Pilots and engineers are on

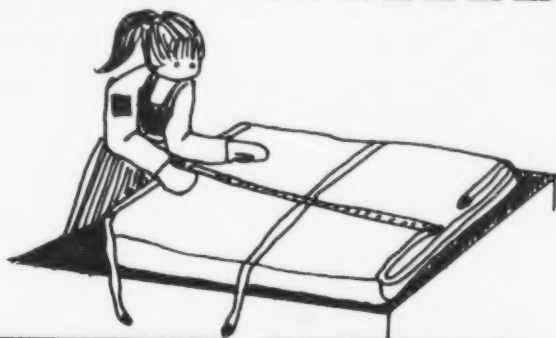
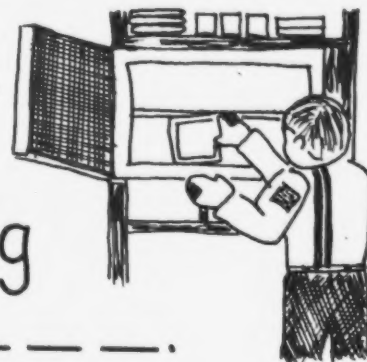
the  _____

plus several types of scientists, too.

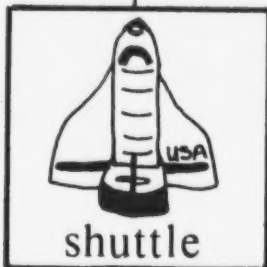
Out in space, these experts from many fields,

also share _____

and
fixing
_____.



crew



shuttle



meals



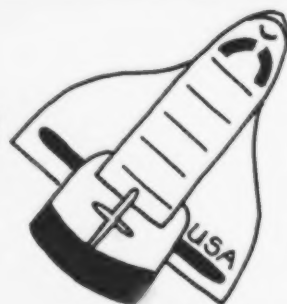
housekeeping

Who's Who

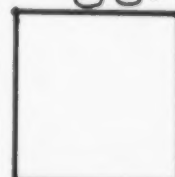
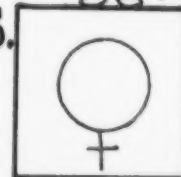
♀
Mary Borman
Kirsti Mikkelson
Sallie Krawcheck

♂
Mike Smith
David Scott
Greg Burch
John Young

on the



Shuttle Crew

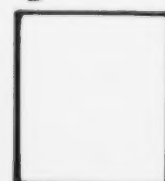


Women and girls, called "females,"
serve on the Space Shuttle Crews.

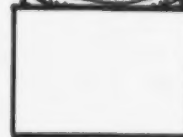
Can you write this female sign
the way most scientists do?

All men and boys are called "males"
and males are astronauts, too.

Can you write the sign for male
the way space scientists do?



We have a special sign, too!



Now what
is the sign
for you?



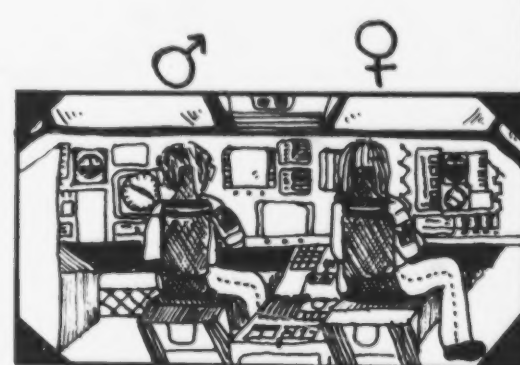
Astronauts Are . . .



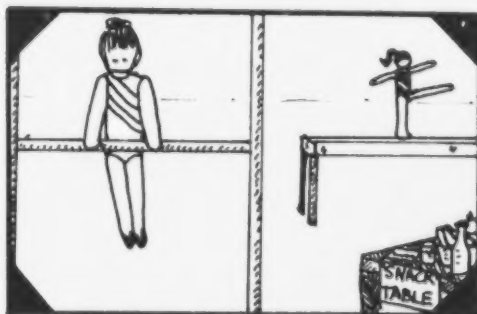
Healthy,



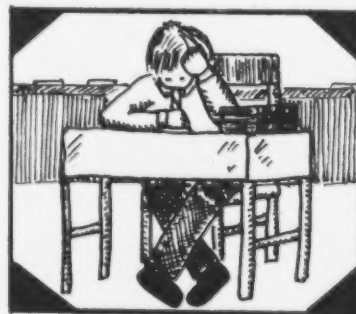
Educated and well-Trained.



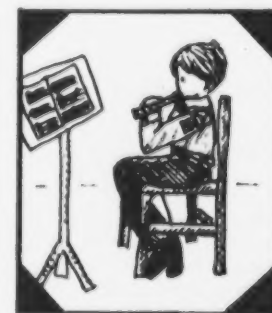
Things you do, while growing up, can help make you the same



Exercise
and the right food
keeps you Healthy.



Trying your best in
school helps you to learn.
You are becoming Educated.



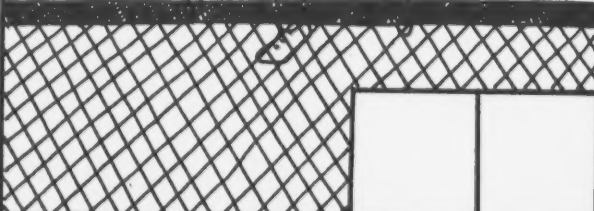
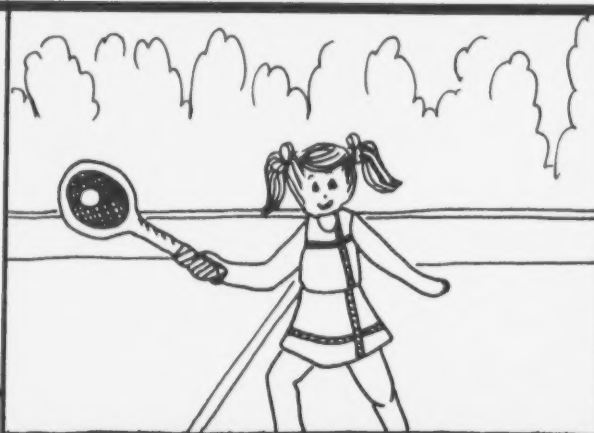
Scouting activities and
music lessons can help
Train your mind and body.

Jenny and Jon may do things like you.
 Perhaps you'd like to be an astronaut, too.
 There are ways to get ready every day.
 Find "astronaut" clues in their work and play.

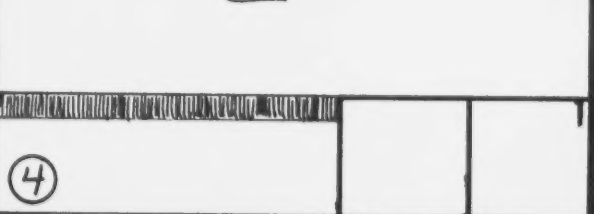
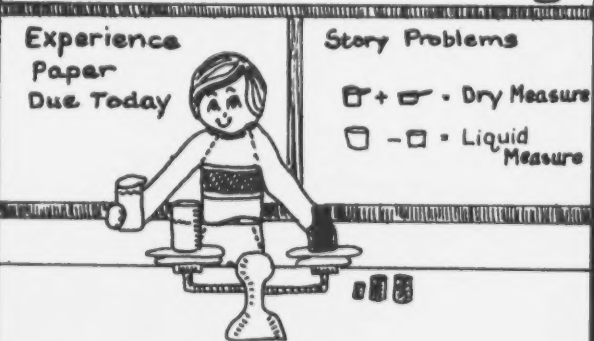
Mark each of the pictures
 with these signs.
 Use the squares you'll find
 on the bottom lines.

Astronaut Clues

- ☐ ~ Jennifer
- ☐ ~ Jon
- ☐ Healthy Activity
- ☐ Education
- ☐ Training Activity



YOU CAN MEASURE UP TO MATH



13 ②

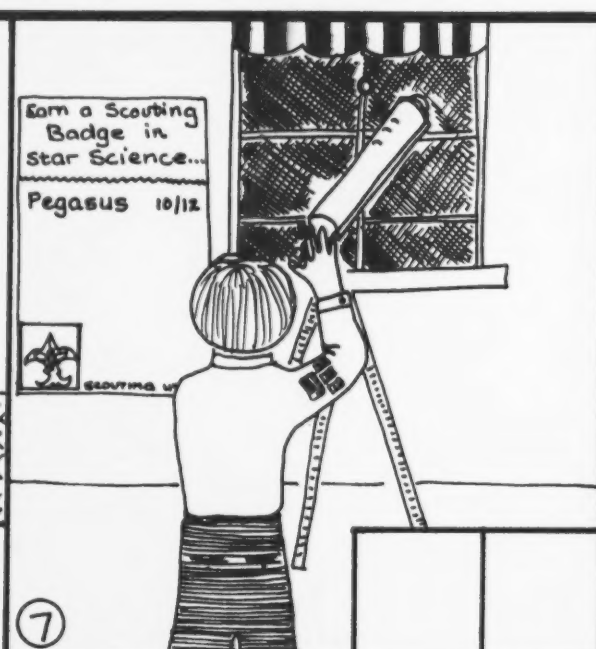
③

④

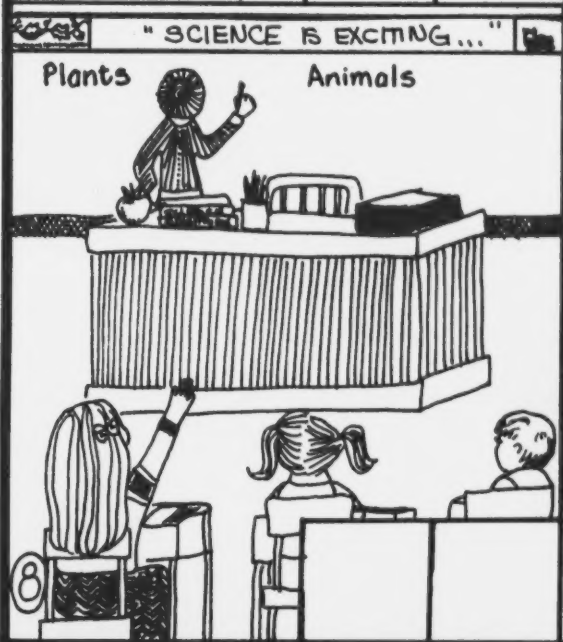
14



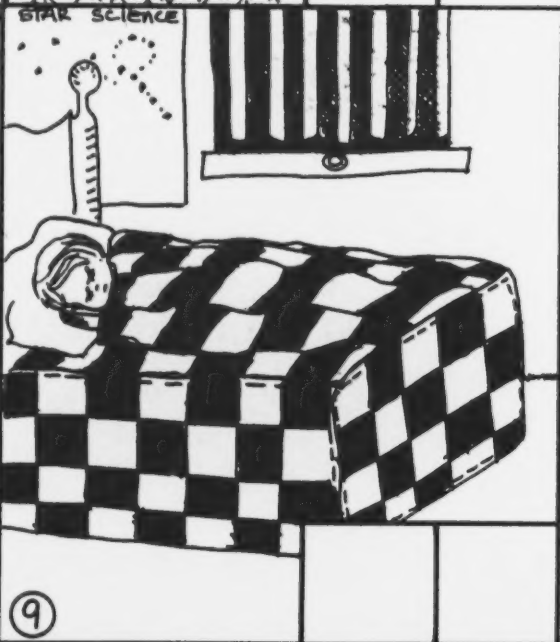
5



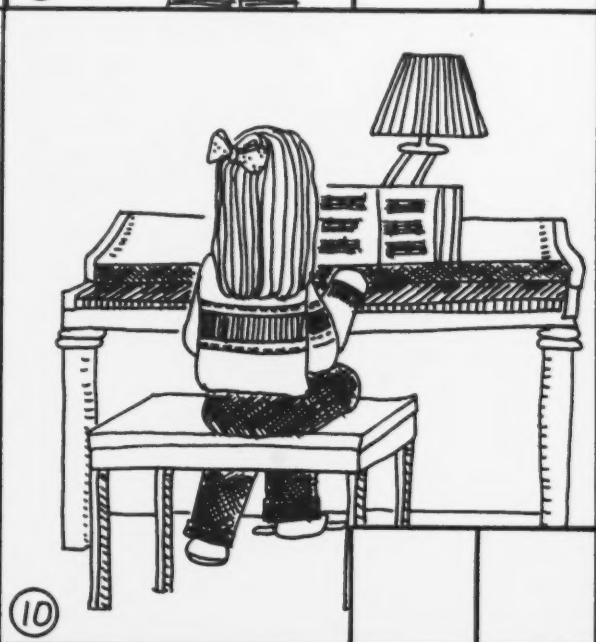
7



8



9



10



Space Travel ~ The *W* and *Push*

Jenny and Jon are going to take
a "make-believe" trip to outer space.
Come journey with them through this book
and give outer space a close-up look.

As people, we live on the *Planet* earth.
(That's a fact we must know first.)
Earth's *pulling force*, called gravity,

helps keep us here. We can't just leave.
Without gravity holding our world in place,
most things would

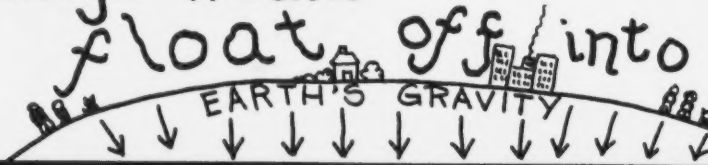
float off into space.



Gravity



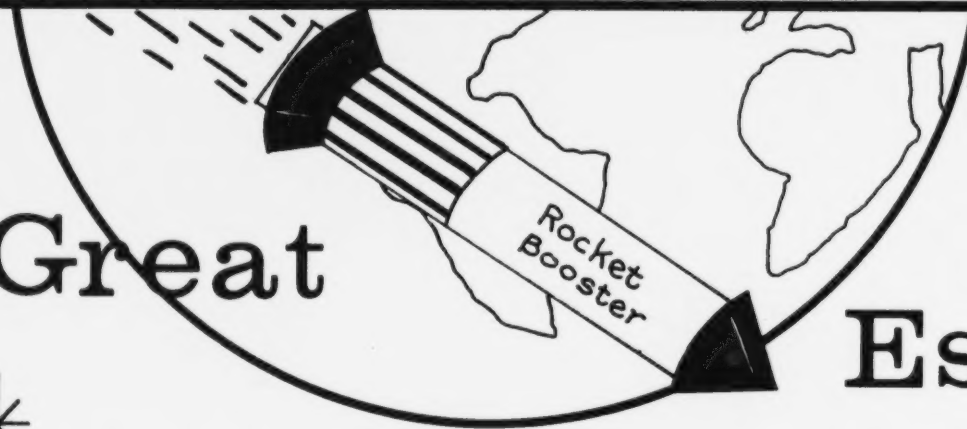
Thrust



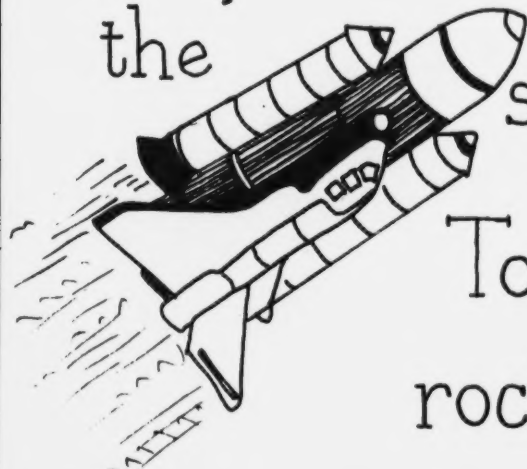
The

Great

Escape



For *pushing* past earth's gravity
the spacecraft will need *thrust*.



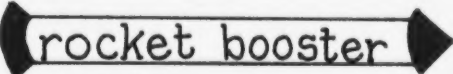
To make the *push* with fuel *power*,
rocket *boosters* are a *must*.

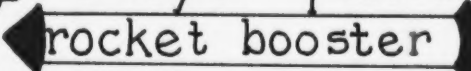


Build a Booster Rocket and play 'Break into Space' see pp 10-11.

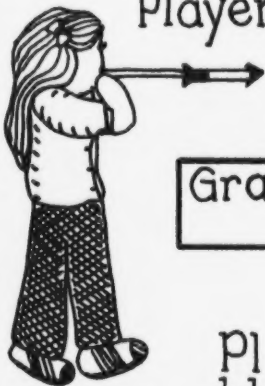
"Break into Space"

The Gravity Game

Object of Game: To *push*  beyond the *pull* of earth's gravity.

How to Play: Player places  on a plastic straw.....

Player faces "Earth's Gravity Line" which is set about 8 feet from starting point. Player can create the "*pull*" of gravity by taking a deep breath with booster straw in mouth.



Gravity = Rocket held in place by *pull*.

Player can produce *thrust* by blowing through straw. If the *thrust*



or *push* causes the player's rocket to

"Break into Space" beyond the Earth's Gravity Line, the player scores a point.

Game time determines number of turns per player.

Thrust = Rocket sent towards space with *push*.

Earth's Gravity Line

Earth's Gravity Line

Staple "Earth's Gravity Line" to piece of clothesline to mark game boundary.

Game Assembly

- A. Cut out pieces #1, #2, #3, along solid black line on outside of piece.
- B. To complete Rocket Collar #1, cut through outside notch to inner circle. Then cut out inner circle, leaving notch. Fold over to notch to form collar and tape or glue in place. *Set aside.*
- C. To complete Nose Cone #2, cut from outside notch to center white dot. Fold over and tape or glue to form cone. *Set aside.*
- D. Roll #3 Rocket Booster on a pencil to curl. Fold over to broken line and tape or glue at top and bottom.
- E. Slide collar #1 on bottom of rocket. Glue Nose Cone #2 to top of rocket. (Seal with glue)

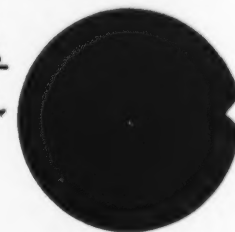
YOU ARE READY TO PLAY

"BREAK INTO SPACE"!

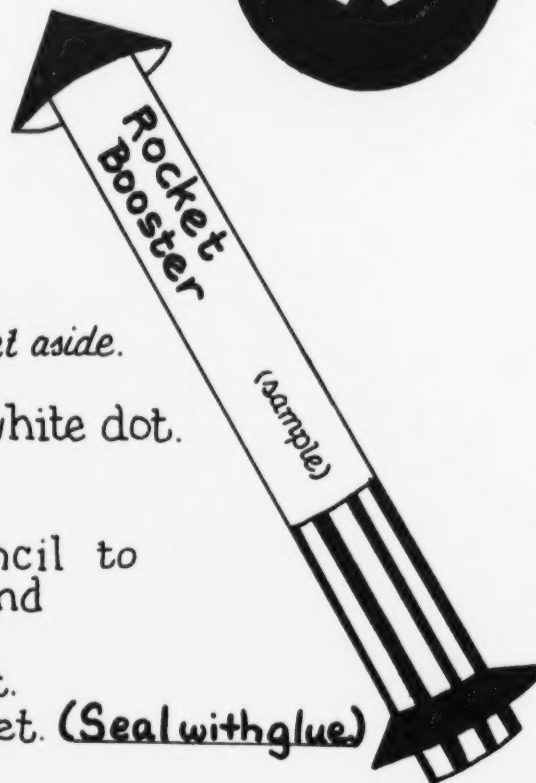
#1
Rocket
Collar



#2
Nose
Cone



#3



Rocket
Booster

(fold to here)

SOLAR SYSTEM

Sing-a-Long

Verse I

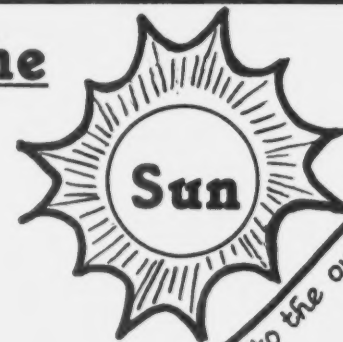
Meet the star at the cen - ter of our
 so - lar sys - tem. We wouldn't get much done with - out the
 sun. The sun warms the air, helps
 plants make food, that's just the be - gin - ning of
 what the sun can do. Meet the sun.

Chords: F, B^b, F, B^b, C, F, G^m, C, F, F



Staging the Solar System

Meet the



Part I

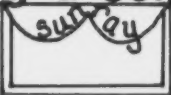


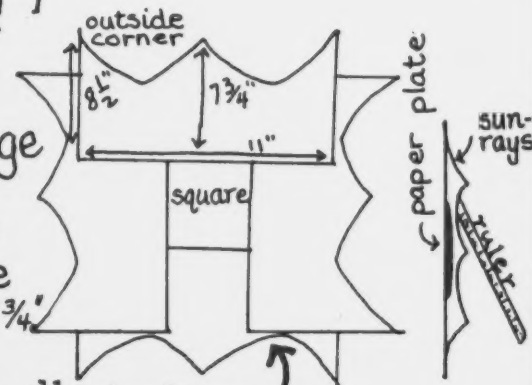
{ The earth's place in space is part of a system, a system that moves around the sun.



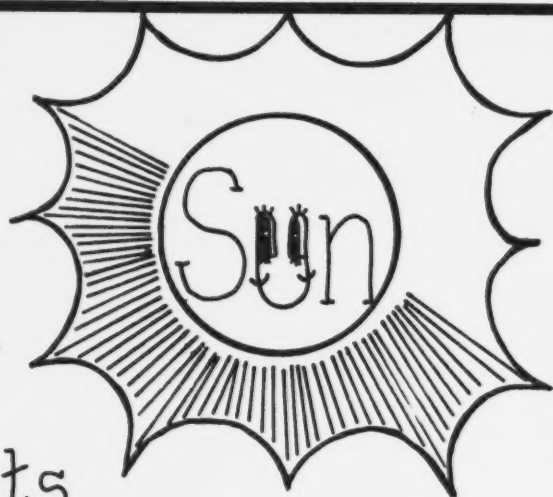
{ Help us stage "An Outer Space Play". You're invited to join in the fun!

Constructing a Sun - The Solar Star

- #1. Cut out  design from a copy of this page to be used as pattern. *Be sure to cut outer lines to the very edge of the paper's outside margin. Use entire paper so width at outside corner is $8\frac{1}{2}$ " and length 11". Middle peak is not as high, $7\frac{3}{4}$ ".
- #2. Cut 4 sunray pieces from orange or yellow fluorescent poster board. Tape in square, boxed pattern, as shown in illustration.
- #3. Staple dinner-size paper plate (11" diameter) to center. Plate may be painted with fluorescent tempera or glue a fluorescent poster board circle ($11\frac{1}{2}$ " diameter) on to plate.
- #4. Staple plate to upper side of sunrays. Insert ruler into corner of square in back so sun can be held up with hand holding ruler.



Turn to the



All living plants
are food machines.

Because of the sun,
most plants are green.

The green is called
plant chlorophyll (KLOR-ah-phil).

Without it plants would not do well.



+

green stems

and
leaves

help make a
plant's
Food Factory.

Sun Science Experiment I

Goal: To observe a plant's need to turn its green parts, especially leaves, toward sunlight

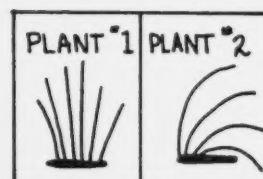


Required: Two potted, green leafy plants. Sun-loving varieties like Spider Plants and Staghorn Ferns will give fairly fast results. (Shade-loving plants require light but can be damaged by direct sun.)



Before starting, demonstrate the word "posture" by standing straight, leaning, etc.

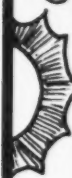
Begin: Have children draw "posture" of both plants using line drawings. Place one plant in sunlight with "posture" facing away from sunlight. Place the other plant in a dark closet, but crack door so some light can enter. Again have plant facing away from the light. Allow enough time for a "posture" change. DRAW THE RESULTS!



Super Science Extra!

Make a "Sunprint" photo and attempt to capture a plant's posture before and after Experiment I. "Sunprints" can be developed using just sunlight and water in 5 minutes! Address and details for obtaining inexpensive Sunprint Kits on inside back cover.

For a "Sunprint" of Experiment I



before
after

Snip a leaf or stem from plant, both before and after exposing to sunlight. Use with Super Sunprint Kit.

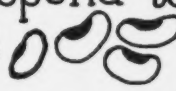
Nature's Cartoon Corner



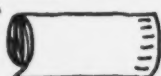
Sun Science Experiment II



Goal: To understand how leaves must have sunlight to produce green chlorophyll and how roots respond to the pull of earth's gravity

Required: dried bean seeds  small plastic bags that can be zipped shut 

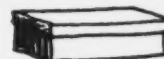
white paper towels



water mister

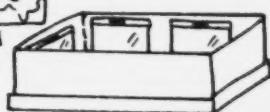


covered shoe box



Before starting, discuss the main purpose of the leaves  (using sunlight to make food) and the roots  (obtaining water).

Begin by soaking Limas (5 minutes), Snap Beans (1 hr.)



Spray mist paper toweling until damp. Roll up and place in bottom of each plastic bag. Set one seed on top of each dampened towel. Zip bag shut and roll-tape to side of shoe box (about six bags per box). Cover the box. Put in warm, dark place. Seeds sprout quickly (1 to 2 days) if temperature is near 70° and fairly constant.

[In cold weather, set the box of bagged seeds inside a black plastic garbage bag. Remove as much air as possible. Twist tie the bag shut and place near warm air register. Presto? You will have a very warm greenhouse and *speedy sprouting seeds!*]

AFTER SEEDS HAVE SPROUTED

Notice the color of the "seedlings." Leave half of the bagged seedlings in the dark and place half in light.

After one day check the color again.

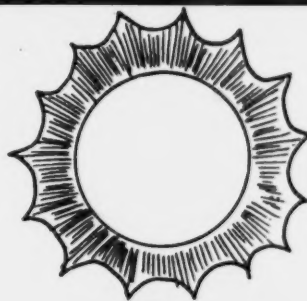
Which seedlings have made chlorophyll?

Notice the direction of the roots. Gravity is helping to pull the roots in a downward direction toward the dampened towel.

Ups and Downs ~ A Science Extra: Make a "Sunprint" of a sprouted seedling to show leaves moving upward to sunlight and roots moving down. Inside back cover has details on the Super Sunprint Kits.



Solar System Sing-a-Long



(F)

(B^b)

verse II

On the Earth we are mov - ing in the

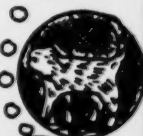
Sol - ar Sys - tem We move in an or - bit round the

Sun. As the Earth or - bits it

spins a - round. And that makes day and night

sci - en - tists have found. Meet the Earth.

17



Staging the Solar System

Paint a Poster Board Earth

- #1. Make copy of p.18 and cut out circle representing the earth. Using this circle as a pattern, trace twice on white poster board and cut out both circles.
- #2. With a brown crayon, color small sections of each poster board circle to represent land.
- #3. Swirl blue finger paint around but not over "land" sections. Three-quarters of the earth's surface is water.
- #4. Punch holes as indicated on pattern and string with yarn so the earth circles can be worn FRONT and BACK.

Notice the earth circles are fairly flat at the top. These flat areas represent the North and South Poles.



Act out the earth orbiting the sun.
Child wearing earth-circles, moves around the sun, while slowly turning.
Facing away from sun = NIGHT.
Facing toward the sun = DAY.

Active Days or Active Nights

Diurnal means Day-active;
Nocturnal means at Night.
Remember the starting letters,
and you'll always get them right.



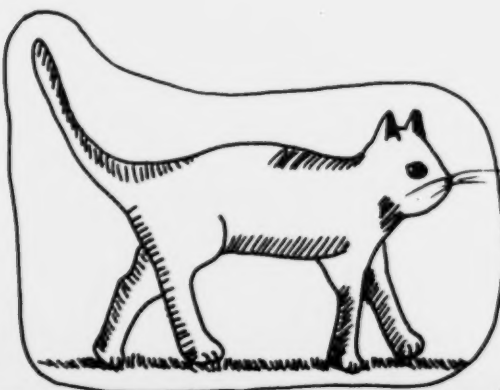
Toad



Grasshopper



Hawk moth



Fire Beetle



Active Days or Active Nights

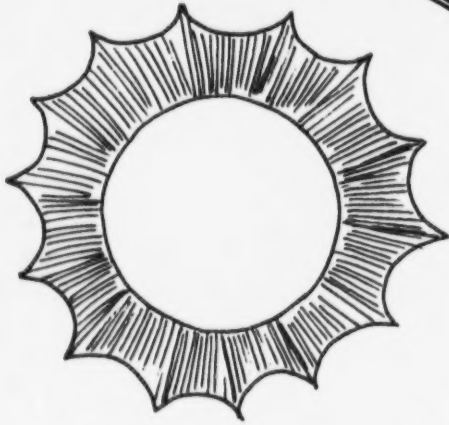
How to play: Copy pp. 19-22.

Children cut out living things pictured on pp. 19-20 using black line frame as cutting guide. Glue day-active in day scene, p. 21 and night-active in night scene, p. 22.



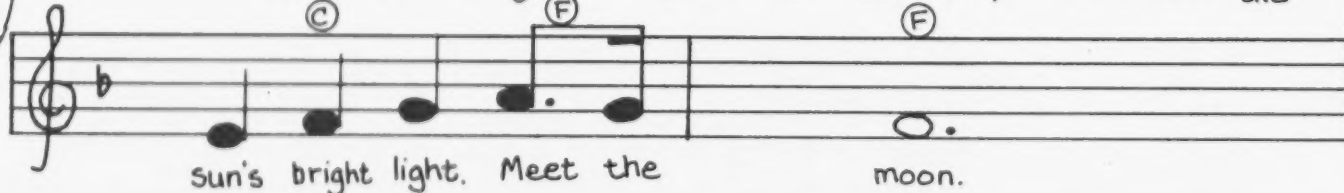
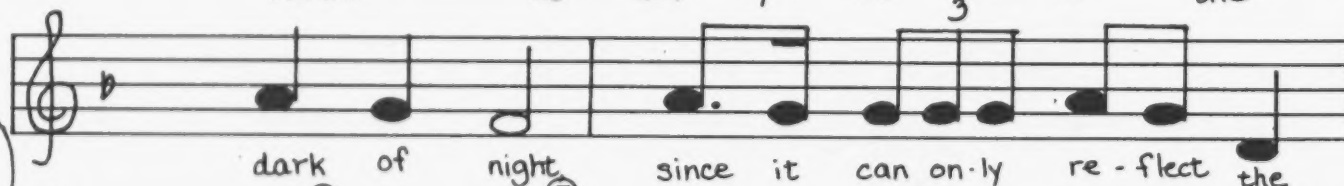
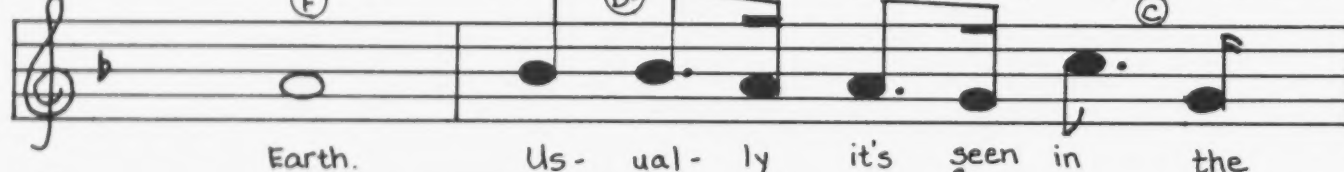
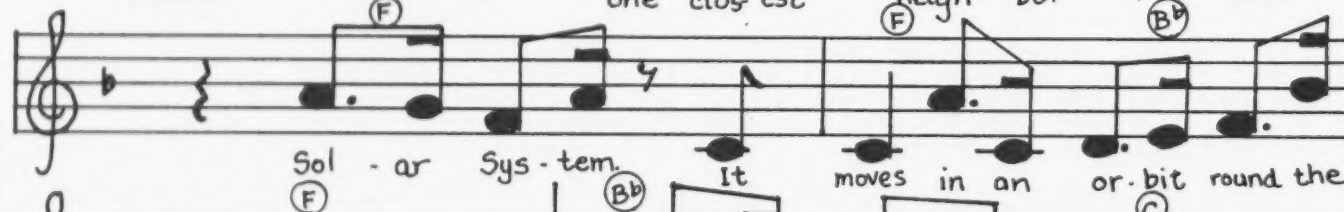
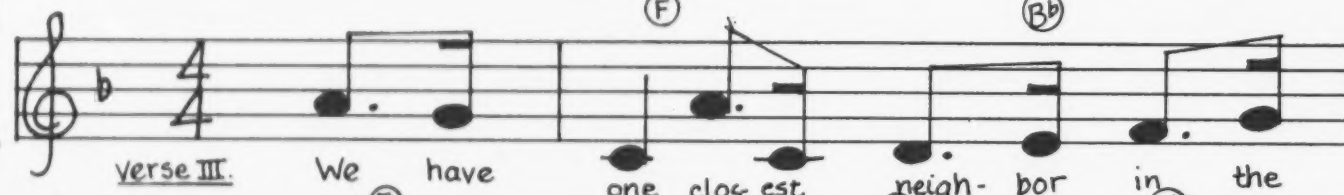
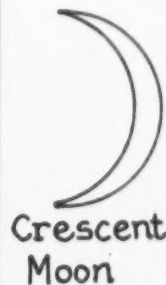
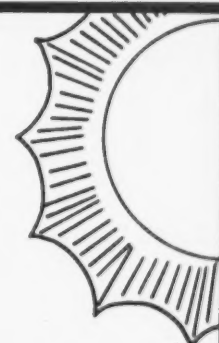
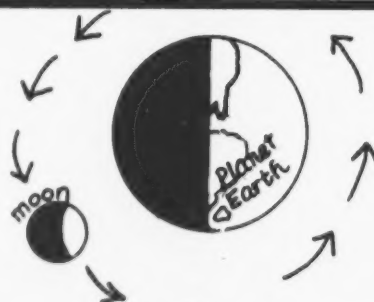
Active Days

(Diurnal)





Solar System Sing-a-Long



Half-Moon



Crescent Moon



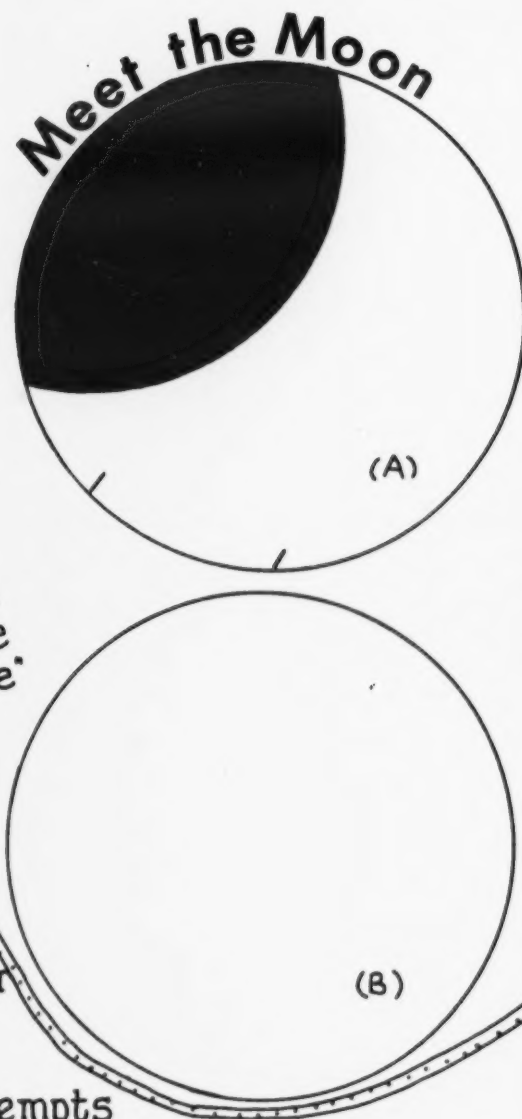
Half Moon

Staging the Solar System

Part III

Making-a-Moon Finger Puppet

- #1. Make a copy of p.24 and cut out complete moon circles A and B. Use the circles as patterns and trace on black, lightweight poster board. Cut both circles from poster board.
- #2. Staple or tape the black poster board circles together along edge, leaving an opening as indicated by slits in the original (A) circle pattern.
- #3. Using the original copy patterns, cut out the white area of circle (A). Trace the resulting moon "shape" and circle (B) onto aluminum foil. Cut out.
- #4. Glue foil pieces on front and back of stapled poster board circles. Presto! You have a Moon Finger Puppet.



Act out the moon's role in space. Again the child playing the Sun (p.13) is the unmoving center of the Solar System. The Earth (p.18) moves around the Sun (orbits) while slowly turning. Finally, a child wearing the finger puppet Moon attempts to move around the Earth (orbit) while everyone sings Verse III, p.23.

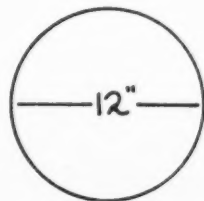
Moon Science Experiment

Goal: To understand how the moon reflects the sun's light

Required:



Flashlight

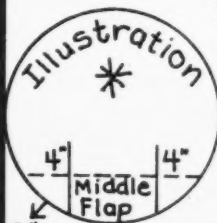


Blue
Poster Board
Circle



Hand
Mirror

Begin: The poster board circle will stand if the following steps are taken. * Cut two 4" slits on both sides at bottom of circle. Then fold middle flap forward, as indicated by broken line in the illustration. The two triangular "side flaps" are folded backwards. These folded flaps will support the circle.



to Fold
Line

The blue circle represents the EARTH. Shine the flashlight (SUN) so it lights the "Day Side" of the EARTH and allows the mirror (MOON) to reflect on the "Night Side" of the EARTH. Jennifer is the SUN and Jon is catching her light with his MOON mirror. He is reflecting that light on the dark or "Night Side of the EARTH."

Reflection Experiment



I've caught your light, Jen!

"Night
Side"

"Day
Side"

Moon Science Engineering

Design and Construct a Lunar (Moon) Lander

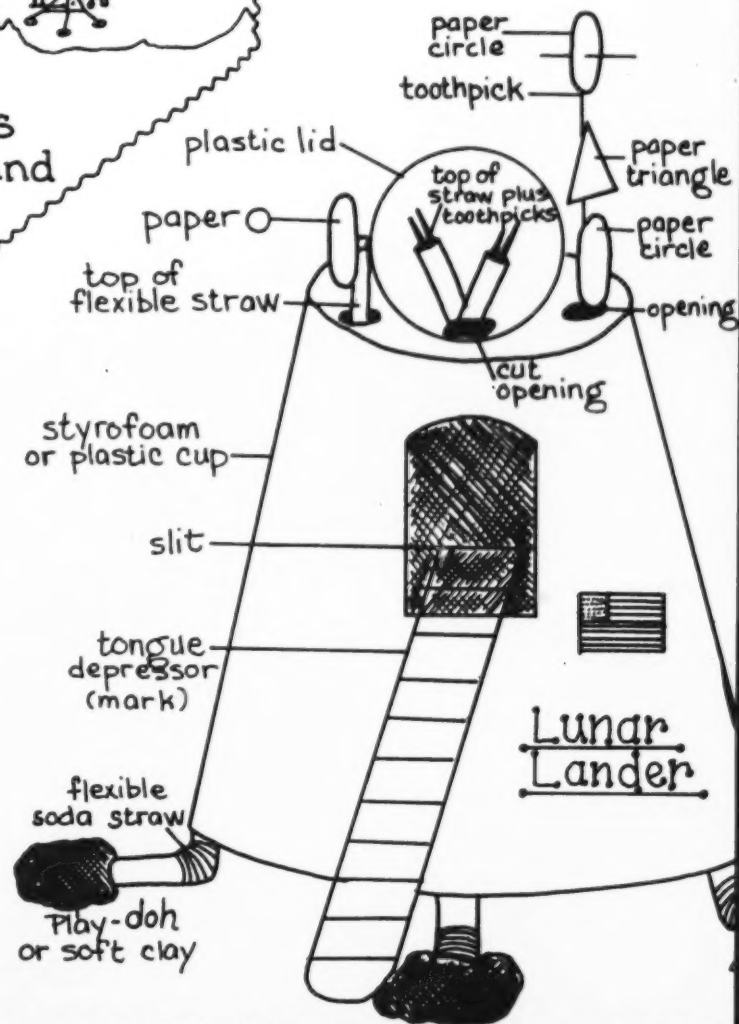
The moon is covered with craters (flat areas surrounded by rocks). The surface is gray and very dusty. A moon craft will need landing "legs" with flat pads to sit on top of the moon dust. This page will give directions for making the Basic Landing Craft. The children may "equip" their Lunar Lander by following the Engineering Blueprint, or they may design their own equipment.

Required: Styrofoam or plastic cup (9 to 12 oz.)

3 Flexible Drinking Straws ~ Tongue Depressor ~ Black Marker ~ Play-doh ~ Masking Tape ~ Toothpicks ~ School Glue ~ Paper Circles, Triangles, Bottle Caps, etc.

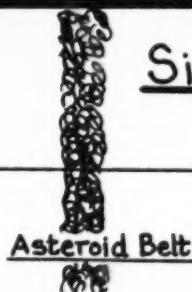
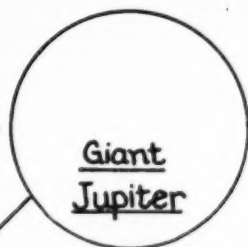
(8"x8") Heavy Cardboard for Display Base.
Basic Model: Cut three openings in bottom of cup. Insert a straw, bending the flexible end out from the cup rim for "leg." Tape straw to inside of cup. Repeat for two more legs. Press feet into Play-doh pads and then press on cardboard base. You are now ready to finish equipping your Lunar Lander for a Moon Mission.

Engineering Blueprint



GOOD LUCK SPACE ENGINEER!

Solar System

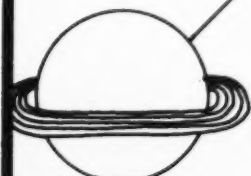


Mars

Earth

Venus

Mercury



Saturn



Uranus



Neptune



Tiny Pluto

Sing-a-Long

Verse IV. There are nine mov-ing plan-ets in our so-lar sys-tem— Mer-cu-ry, Ve-nus, Earth and Mars. Gi-ant Ju-pi-ter, ringed Sa-turn and U-ran-us, Neptune and ti-ny Pluto in a gal-ax-y of stars. Meet the plan-ets.

Chords: F, Bb, F, Bb, F, Bb, F, Gm, F, C, F, F.

Staging the Solar System

Part IV



#1 Make 4 copies of p.28 and cut out one circular pattern of the individual planet from each copy.

#2 Venus is the hottest

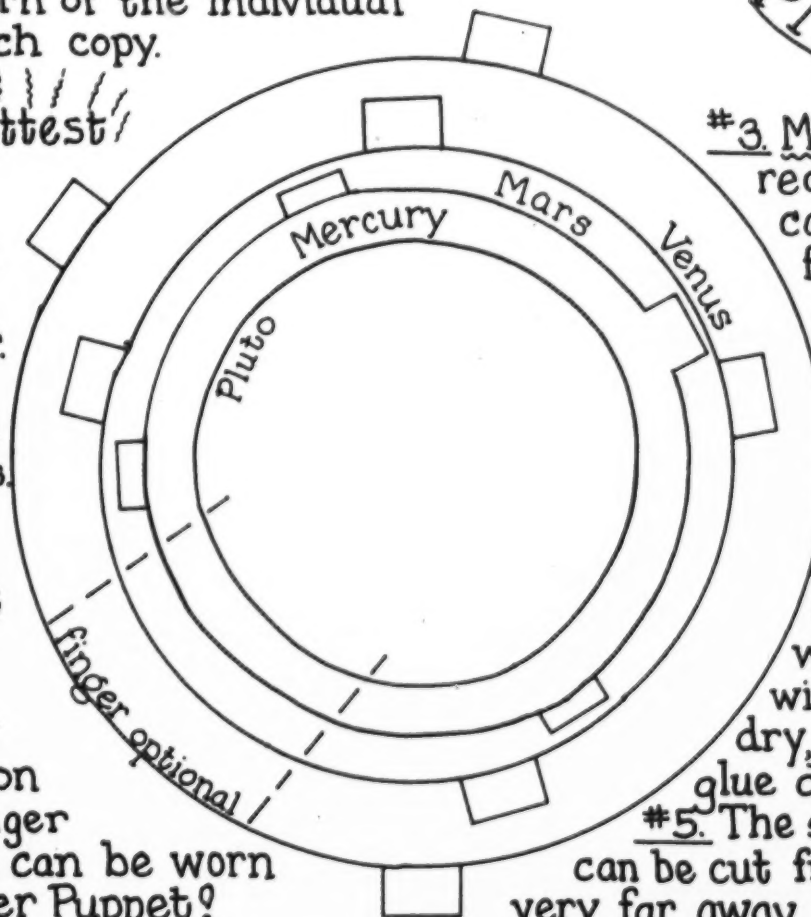
planet. Cut two circles for this planet out of dull yellow or gold construction paper.

Draw cracks and glue pieces of sponge for rocks on both circles.

Then proceed to Finish: Fold tabs

alternately against the second circle and staple, tape or glue in place.

Place one staple on either side of finger opening so Venus can be worn as a Planet Finger Puppet?



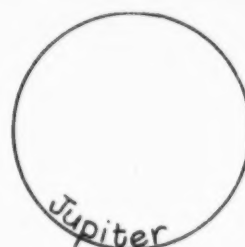
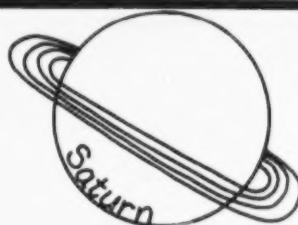
#3 Mars is covered with red rock. It has ice caps. Cut two circles for Mars out of red construction paper. Glue cotton at top and bottom. Finish finger puppet as in #2.

#4 Cut Mercury out of gray construction paper.

Cover outside surface with glue and sprinkle with sand. Mercury is a dry, lifeless desert. When glue dries finish, as in #2.

#5 The smallest planet, Pluto, can be cut from purple paper. It is very far away and little is known about this planet. Simply staple circles together to make the smallest finger puppet.

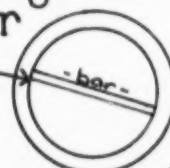
Paper Plate Planets



#6 Neptune is made of two dessert-size paper plates, 6" diameter. Color the under-side of both plates with blue and green crayons. Staple or glue upper sides together, after stringing with yarn, so planet can be worn around neck.

#7 Ringed Saturn and Uranus require three dinner-size (9") and one banquet-size (11") paper plates. Fingerpaint two of the dinner plates in swirling orange and yellow for the gases that make up the planet Saturn. Make a copy of p. 29 and using the circle pattern for Uranus, cut two circles from green poster board. Cut rings from 9" and 12" paper plates, leaving a $\frac{1}{2}$ " bar in center of plate as shown here.

Place the planet circles over bar and staple around edges to form ringed planet. Glue sponge and styrofoam pieces to "rings" to look like rocks and ice in space.



#8 Make Giant Jupiter from two 11" paper plates stapled together. Finger-paint red and yellow.



Act out the planets in our Solar System. Verse IV is the perfect musical accompaniment, as it names the planets in the order that they occur away from the sun. Begin with the Sun on stage to the far right with each planet to follow in its turn. One child represents a planet and takes the stage as the planet's name is sung.

Space Science Candidate:

has qualified as a Future Astronaut

The following "Special Assignments" were completed:

- ☐ Conducted Scientific Experiments   
- ☐ Member of Production Staff, Solar System Play. 
- ☐ Space Engineering   
Designed and/or constructed Rocket Booster and Lunar Lander.
- ☐ Participation in Sports, Scouting, Music, or other Healthy and Educational Activities.   



Signed: _____
Space Science Facilitator

TEACHER/PARENT GUIDE

WORDS & SPACES (pp. 2-3)

Answer Key: space suit, astronaut, shuttle, men, women, shuttle, crew, housekeeping, meals

ASTRONAUTS ARE.... (pp. 5-7)

Answer Key:

- | | |
|---------------|----------------|
| (1) Female, H | (2) Male, H |
| (3) Female, T | (4) Male, E |
| (5) Male, T | (6) Female, H |
| (7) Male, T | (8) Female, E |
| (9) Male, H | (10) Female, T |

Note: Students make the sign for male or female, rather than write the word.

STAGING THE SOLAR SYSTEM (p. 13)

The "star" of this Space Play will be the Sun. A child is chosen to hold the newly constructed Sun in center stage while the other children sing verse I of the song, p. 12.

SUN SCIENCE EXPERIMENTS I & II (pp. 15-16)

"SUNPRINTS" An Exciting Science Extra

A quick (5 minutes to develop) and easy-to-use Sunprint Photo Kit is available from:

Discovery Corner, Dept. A
Lawrence Hall of Science
University of California
Berkeley, California 94720

Write for free catalog or call 415-642-1016 to order kits by phone.

Regular Sunprint Kit makes 30 (4" x 4") prints
@ \$5.00

Super Sunprint Kit makes 24 (8" x 12") prints
@ 7.50

Super Sunprint Refill with additional 24 sheets
@ 3.95

Note: Space scientists have been able to grow perfect crystals in the weightlessness of space. Children will enjoy growing Space Age Crystals in water. **Crystal Kits** are also available from Discovery Corner.

ACTIVE DAYS OR ACTIVE NIGHTS (pp. 19-22)

Answer Key:

Day Active: Ladybugs, grasshopper, sunflower, spider, squirrel, woodpecker, Jon (boy), Jennifer (girl), butterfly, flower, honeybee, hen, rooster, praying mantis, second butterfly, bird, more ladybugs

Night Active: Io moth, snail, mouse, hawk moth, bat, cat, owl, stag beetles, raccoon, lightning bugs, frog, luna moth

Note: It would be fun to make "Sunprint" photos of the living things that are day-active.

STAGING THE SOLAR SYSTEM (pp. 28-29)

When the planet props are not being used for the Solar System Play, **they make an attractive Science Table Display.** Cut 8" x 5" place cards from leftover poster board. Fold the place cards in half, the long way, and label one card for each of the nine planets. Cut a small slit in the center of the folded place card and insert a tongue depressor. The individual planets, with the exception of planet earth, can rest above the place card by pushing the tongue depressor up the middle of the planet piece. For planet earth, simply roll tape to front and back of depressor. Follow song p. 27, to label planets. **Remember to use all four verses of the song when staging the complete play of the solar system!**

GOOD APPLE, INC., P.O. BOX 299, CARTHAGE, IL 62321-0299